

Indiana Metals Rulemaking : Selenium 2016 NRWQC

USEPA Region 5 State/Tribal
WQS Workgroup
March 14, 2019



Overview

- Indiana Metals Rulemaking
- Selenium 2016 NRWQC overview
- Implementation challenges
- Other state experiences
- Status



- Indiana Metals Rulemaking
 - Purpose: to update HH and AL metals criteria in waters within and outside the GLI
 - Not proposing to adopt Copper BLM or 2018 Aluminum NRWQC



- First Notice: March 14, 2014
 - Tables with proposed criteria
 - 30-day comment period
 - No Comments
- Moratorium on rulemaking
- 2016 NRWQC for AL for Selenium 6/30/16
- Moratorium on rulemaking ends
 - IDEM proposed in the First Notice to adopt GLI chronic Se ALC into Downstate rules.
 - Currently 1980 criteria (35 ug/L chronic and 130 µg/L acute)
 - Stakeholders intervened, requested 2016 Se NRWQC



Table 1. Summary of the Recommended Freshwater Selenium Ambient Chronic Water Quality Criterion for Protection of Aquatic Life.

Media Type	Fish Tissue ¹		Water Column ⁴	
	Criterion Element	Egg/Ovary ² Fish Whole Body or Muscle ³	Monthly Average Exposure	Intermittent Exposure ⁵
Magnitude	15.1 mg/kg dw	8.5 mg/kg dw whole body or 11.3 mg/kg dw muscle (skinless, boneless filet)	1.5 µg/L in lentic aquatic systems 3.1 µg/L in lotic aquatic systems	$WQC_{int} = \frac{WQC_{30-day} - C_{bkgrnd}(1 - f_{int})}{f_{int}}$
Duration	Instantaneous measurement ⁶	Instantaneous measurement ⁶	30 days	Number of days/month with an elevated concentration
Frequency	Not to be exceeded	Not to be exceeded	Not more than once in three years on average	Not more than once in three years on average

1. Fish tissue elements are expressed as steady-state.

2. Egg/Ovary supersedes any whole-body, muscle, or water column element when fish egg/ovary concentrations are measured.

3. Fish whole-body or muscle tissue supersedes water column element when both fish tissue and water concentrations are measured.

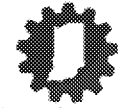
4. Water column values are based on dissolved total selenium in water and are derived from fish tissue values via bioaccumulation modeling. Water column values are the applicable criterion element in the absence of steady-state condition fish tissue data.

5. Where WQC30-day is the water column monthly element, for either a lentic or lotic waters; C_{bkgrnd} is the average background selenium concentration, and f_{int} is the fraction of any 30-day period during which elevated selenium concentrations occur, with f_{int} assigned a value ≥ 0.033 (corresponding to 1 day).

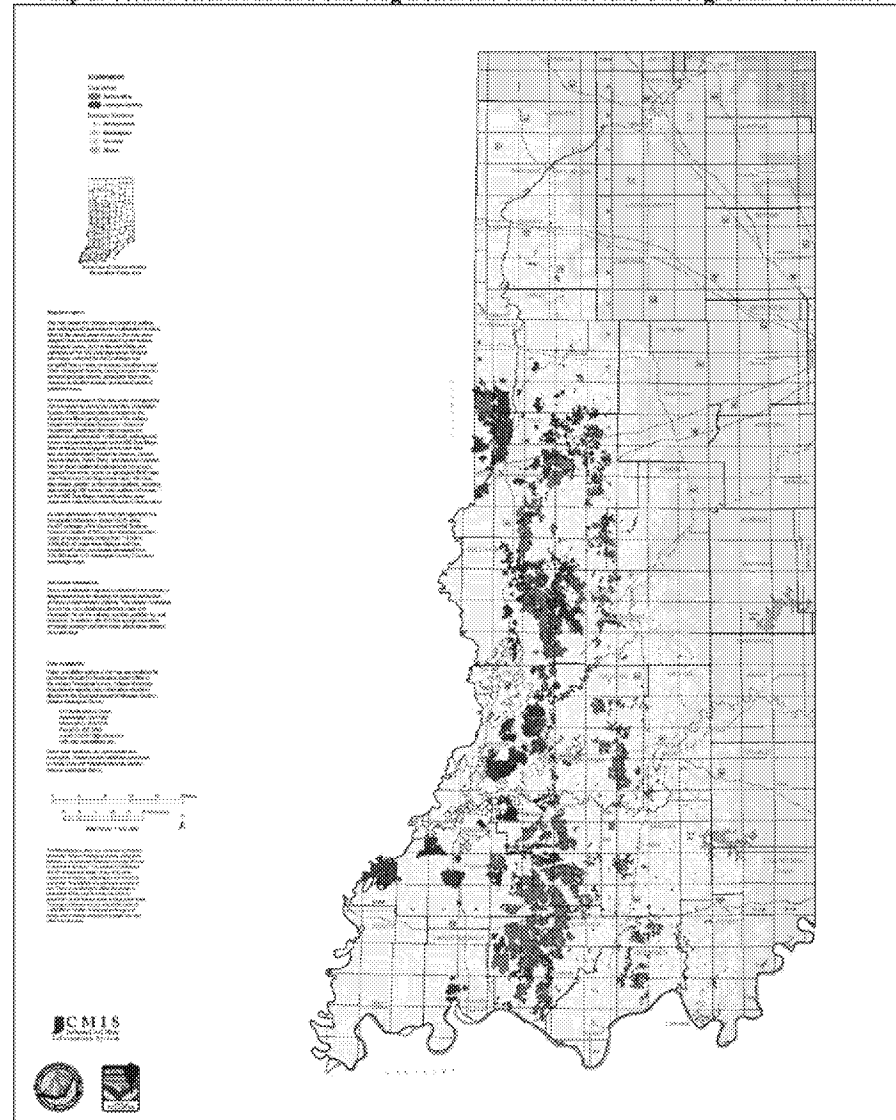
6. Fish tissue data provide instantaneous point measurements that reflect integrative accumulation of selenium over time and space in fish population(s) at a given site.

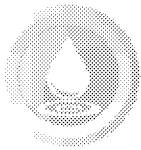


- Why the push for 2016 Se NRWQC?
 - Neighboring states (KY and WV) have fish tissue based Se criterion that pre-date the 2016 Se NRWQC
 - KY – exceedances of water column criterion element a “trigger” when permit limit exceeded
 - Sample fish within 30 days to demonstrate compliance with water column criterion (5.0 µg/L)
 - No intermittent water column criterion element
 - WV- collect data to derive a site-specific criterion if exceed water column criterion (5.0 µg/L). Two options:
 - Derive NPDES water column limits using site specific bioaccumulation factor (BAF) approach (Appendix K)
 - Assign fish tissue limits in NPDES permits with compliance monitoring schedule; if exceed, BAF approach required
 - No intermittent water column criterion element
 - Certain IN stakeholders want option to use fish tissue criterion elements to demonstrate compliance with criterion
 - Mining intermittent discharges to headwater streams, other interested stakeholders discharge to larger rivers.

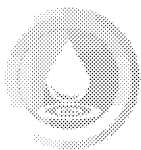


Map of Southwestern Indiana Showing Locations of Surface and Underground Coal Mines





- Second Notice: November 15, 2017
 - 30-day comment period
 - Included 2016 Se NRWQC in GLI and Downstate, with footnote modifications requested by stakeholders
- Extension for comment period (to March 2017)
 - IN Coal Council submitted GEI Consultants *Recommended Updates to Indiana's Selenium Aquatic Life Standards*
 - 14 comments, many in support of GEI recommendations



- **Summary of GEI Recommendations:**
 - Modify egg-ovary toxicity endpoints in the 2016 NRWQC species sensitivity distribution and recalculate criteria.
 - White sturgeon, blue gill, fathead minnow
 - Use regression instead of trophic transfer to derive whole fish, fillet and water column criterion elements
 - Acute criteria bio kinetic model instead of intermittent water column criterion element
 - For selenate dominated waters, sulfate dependent model is used for site specific criteria and intermittent criteria.



- Summary of GEI Recommendations (cont'd):
 - Implement a “non-sturgeon waters” SSC for portions of Indiana
 - Based on Idaho, 2018
 - White sturgeon most sensitive in NRWQC species sensitivity distribution (SSD)
 - GEI assumed sturgeon rare in Indiana
 - No occurrence and distribution data provided
 - Did not recommend removing other species from SSD
- Many GEI recommendations submitted during comment periods for prior draft selenium NRWQC (2004, 2014, 2015).



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Magnitude	15.1 mg/kg dw	8.5 mg/kg dw whole body or 11.3 mg/kg dw muscle (skinless, boneless filet)	1.5 µg/L in lentic aquatic systems 3.1 µg/L in lotic aquatic systems	$WQC_{int} = \frac{WQC_{30-day} - C_{bkgrnd}(1 - f_{int})}{f_{int}}$
Duration	Instantaneous measurement ⁶	Instantaneous measurement ⁶	30 days	Number of days/month with an elevated concentration
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1. Fish tissue elements are expressed as steady-state.

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3. Fish whole-body or muscle tissue supersedes water column element when both fish tissue and water concentrations are measured.

4. Water column values are based on dissolved total selenium in water and are derived from fish tissue values via bioaccumulation modeling. Water column values are the applicable criterion element in the absence of steady-state condition fish tissue data.

5. Where WQC30-day is the water column monthly element, for either a lentic or lotic waters; C_{bkgrnd} is the average background selenium concentration, and f_{int} is the fraction of any 30-day period during which elevated selenium concentrations occur, with f_{int} assigned a value ≥ 0.033 (corresponding to 1 day).

6. Fish tissue data provide instantaneous point measurements that reflect integrative accumulation of selenium over time and space in fish population(s) at a given site.



Table 18: Recommended Se criterion elements for waters containing sturgeon in Indiana.

Media Type	Fish Tissue			Water Column ³	
Criterion Element	Egg/Ovary ¹	Fish Whole-Body ²	Muscle ²	Monthly Average Exposure	Intermittent Exposure
Magnitude ⁴	17.3 mg/kg	9.0 mg/kg whole-body	12.3 mg/kg muscle (skinless, boneless filet)	4.2 µg/L in lotic systems ⁵ 2.2 µg/L in lentic systems	Site-specific
Duration	Seasonal average	Seasonal average	Seasonal average	30 days	Site-specific
Frequency	Not more than once in three years on average	Not more than once in three years on average	Not more than once in three years on average	Not more than once in three years on average	Site-specific

1. Overrides any whole-body, muscle, or water column elements when fish egg/ovary concentrations are measured.
2. Overrides any water column element when both fish tissue and water concentrations are measured.
3. Water column values are based on dissolved selenium in water.
4. Magnitude is the geometric mean of tissue samples collected.
5. In selenate dominated waters the sulfate-dependent model is allowed for site-specific water column criteria.



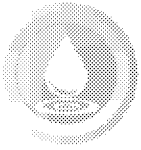
Table 19: Recommended Se criterion elements for waters not containing sturgeon in Indiana.

Media Type	Fish Tissue			Water Column ³	
Criterion Element	Egg/Ovary ¹	Fish Whole-Body ²	Muscle ²	Monthly Average Exposure	Intermittent Exposure
Magnitude ⁴	20.7 mg/kg	9.6 mg/kg whole-body	13.1 mg/kg muscle (skinless, boneless filet)	7.2 µg/L in lotic systems ⁵ 3.2 µg/L in lentic systems	Site-specific
Duration	Seasonal average	Seasonal average	Seasonal average	30 days	Site-specific
Frequency	Not more than once in three years on average	Not more than once in three years on average	Not more than once in three years on average	Not more than once in three years on average	Site-specific

1. Overrides any whole-body, muscle, or water column elements when fish egg/ovary concentrations are measured.
2. Overrides any water column element when both fish tissue and water concentrations are measured.
3. Water column values are based on dissolved selenium in water.
4. Magnitude is the geometric mean of tissue samples collected.
5. In selenate dominated waters the sulfate-dependent model is allowed for site-specific water column criteria.



- IDEM did not accept most GEI recommendations were valid:
 - Did not conform to recalculation procedure
 - No Indiana specific paired water column and fish tissue data
- Evaluated SSC non-sturgeon waters, recalculation procedure
 - Sturgeon occurrence and distribution confirmed in literature and with IDEM/IDNR biologists
 - 2016 Se NRWQC apply where sturgeon are resident, have occurred or have used for spawning, and a buffer for these waters: SSC outside these areas.



- Sturgeon in Indiana (Order Acipenseriformes)
 - Lake Sturgeon (*Acipenser fulvescens*)
 - State Endangered Species
 - Last population in a river in entire Ohio River Basin
 - Shovelnose Sturgeon (*Scaphirhynchus platyrhynchus*)
 - Common in larger rivers, populations declining due to overharvesting and poaching
 - American paddlefish (*Polyodon spathula*)
 - Paddlefish protected in IN: may not be taken from any portion of Indiana waters of the Ohio River and it is illegal to take paddlefish from any Indiana waters on a sport fishing license.
 - Acipenseriformes have been afforded international protection by being listed as a species under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).
 - Caviar- harvesting pressure - poaching



Federal agents raid home of southern Indiana fisherman (May 15, 2017)

"Cox says the agents seized 600 pounds of caviar worth more than \$50,000 as well as \$20,000 in cash and checks, fishing records, one of his boats and a truck."





Sturgeon (Order Acipenseriformes) in Indiana

1. Lake Sturgeon
2. Shovelnose Sturgeon
3. Paddlefish



8 PADDLEFISH—*Polyodon spathula* (Walbaum). Large, eel-like paddle, with elongate body shape like a shark. Snout about a third of TL. Mouth large, jaws without teeth. Unscaled except on caudal peduncle. Gill cover with large fleshy, pointed flap on posterior edge. Eye tiny. Grayish blue to nearly black, sometimes mottled above, and white below. Mississippi River basin from NY to LA, including Gulf Slope from TX to AL. Extirpated from Lakes Erie and possibly Michigan. Rare to occasional. Large rivers including shoals and deep waters. Planktivore drift feeder. Open substrate, lithopelagophili (A.I.2). Maximum size 1,500 mm TL.



9 LAKE STURGEON—*Acipenser fulvescens* Rafinesque. Cone-shaped snout; spiracle present; upper half of caudal fin without long filament. Anal fin origin behind dorsal fin origin. Caudal peduncle long but thick, tip of anal fin extending to anterior edge of paired caudal rays. Olive-brown to gray above, white below, dark gray or brown fins. Anal rays 24-30, gill rakers 32-35; scutes on back 9-12, lateral scutes 29-42. Great Lakes and Hudson Bay basins throughout Mississippi River. Rare to occasional. Large rivers occupying benthic habitats over sand, gravel, and muck. Benthic invertebrate feeder. Open substrate, lithopelagophili (A.I.2). Maximum size 1,600 mm FL (distance to fork in caudal fin).



10 SHOVELNOSE STURGEON—*Scaphirhynchus platyrhynchus* (Rafinesque). Snout flat and shovel-shaped. Fleshy lobes on lower lip 4, with 4 fringed barbels. Caudal peduncle long and slender and covered with bony scutes. Caudal fin with elongate filament. No spiracle. Scutes on belly except in small juveniles. Bases of outer barbel in line or anterior of inner barbel. Light brown or tan above, white below; brown or tan fins. Anal rays 16-21. Mississippi River basin from PA to ME, south to LA. Common. Large rivers in main channel over sand, gravel, or woody debris snags. Benthic invertebrate feeder. Open substrate, lithopelagophili (A.I.2). Maximum size 605 mm FL (distance to fork in caudal fin).



11 ALLIGATOR GAR—*Atractosteus spatula* (Lacepede). Short, broad, duck-shaped snout; upper jaw length shorter than distance from mouth edge to gill openings; 2 rows of teeth on upper jaw. Dark olive-brown or black above, white to yellow below; fins dark brown with spots on median fins. Juveniles black with white dorso-median arrow from dorsal fin to snout. Predorsal scales 48-54, gill rakers 59-66. Mississippi River basin from OH and IL to Gulf of Mexico; from Escambia River, FL, to Veracruz, Mexico. Extremely rare; previously considered extirpated. Large rivers in pool habitat associated with large trees and woody debris; previously found in riverine wetland habitats. Ambush carnivore. Open substrate, phytophil (A.I.3). Maximum size 1,040 mm TL.



8 PADDLEFISH—
Polyodon spathula



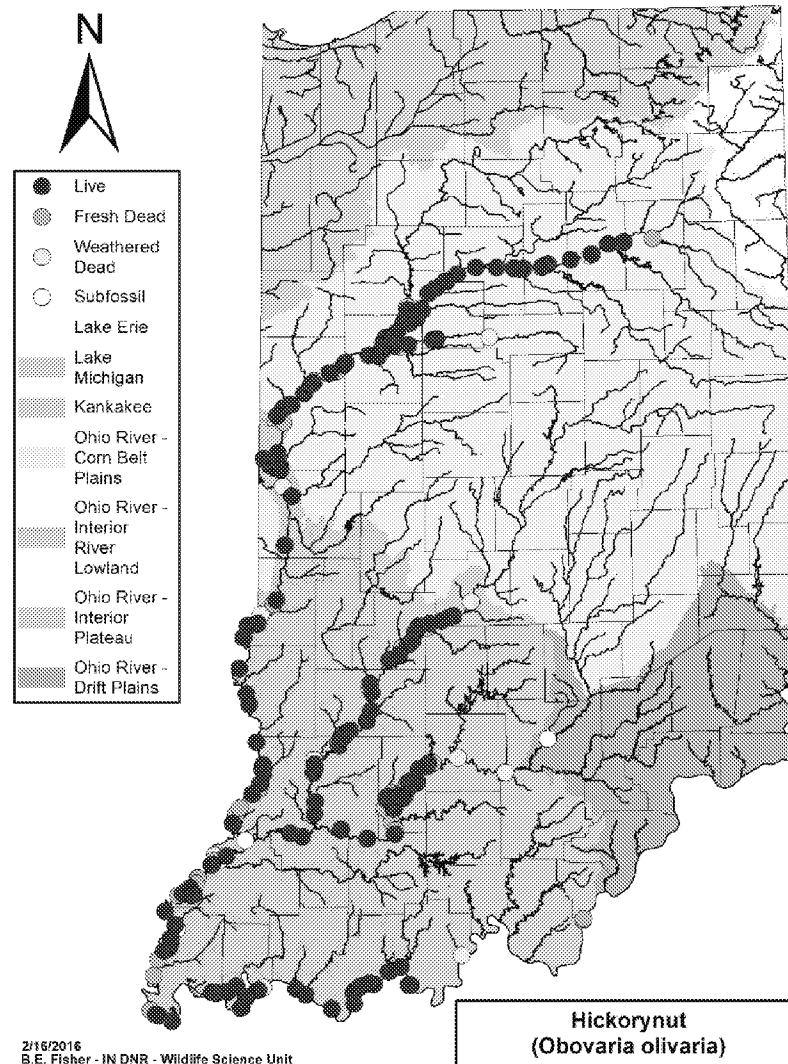
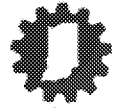
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Acipenser fulvescens



10 SHOVELNOSE STURGEON—
Scaphirhynchus platyrhynchus



11 ALLIGATOR GAR—
Atractosteus spatula

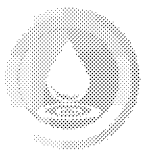




- Se rulemaking challenges
 - Responding to stakeholder concerns
 - IDEM did not accept most GEI recommendation
 - Multiple meetings since 2nd Notice to discuss
 - Sturgeon waters/non-sturgeon waters criterion
 - Water column criterion elements challenging
 - » KY and WV experience
 - WQC exceedances but may meet fish tissue
 - Compliance cost concern
 - Regional criteria, site-specific criteria, or water column criterion based on the intermittent exposure equation.



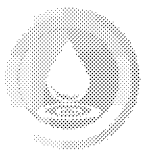
- Rulemaking challenges, cont'd
 - Se Implementation
 - IDEM has developed draft guidance for the collection of fish tissue and/or water column data
 - Can be used to calculate a site-specific selenium criterion using the empirical BAF approach (Appendix K)
 - Can be used to assess if fish tissue meets selenium criterion fish tissue elements.
 - Intermittent exposure criterion implementation challenges
 - For large sites, which outfalls, how to tally discharges
 - Headwater streams – preferred fish sampling hierarchy limited



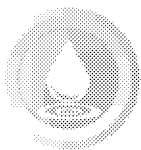
- Developed guidance for the collection of fish tissue and/or water column data (cont'd)
 - Includes target species, priority ranking
 - » Must collect fish that bioaccumulates and are sensitive
 - » Different requirements for headwater streams
 - Includes requirements to sample water column
 - » Compliance demonstration
 - » Calculation of a BAF (more intensive sampling)
 - Includes methods
- IDEM does not intend to develop fish-tissue based permit limits (WV)



- Final Rule Language
 - In process
 - Will include USEPA 2016 Se NRWQC for Great Lakes System waters.
 - Late 2019 target.



- Other States implementing 2016 Se NRWQC
 - Idaho, 2018
 - Five site-specific criteria
 - Phosphate mine areas -fish tissue and water column, industry research and proposals (4)
 - Non-sturgeon waters (fish tissue, no water column)
 - Sturgeon waters (2016 Se NRWQC)
 - White sturgeon –most sensitive in SSC - resident species and buffer (HUC 8)
 - <http://www.deq.idaho.gov/laws-rules-etc/deq-rulemakings/docket-no-58-0102-1701/>



- Other States (cont'd)
 - Montana Lake Koocanusa
 - Reservoir on Montana-Canada border
 - International waters
 - Canadian coal mine discharges
 - Adverse impacts to fisheries in reservoir –rising concentrations in fish tissue
 - Se in ground water supply well of a PWS exceeded Canadian HH WQC for selenium, and was closed
 - USGS mechanistic model
 - Will propose lentic criterion
 - Proposed lentic criterion may be less than NRWQC



- California (Draft, 2018)
 - Aquatic Life and Aquatic-Dependent Wildlife Selenium Criterion
 - Bird egg tissue supersedes fish egg-ovary, no water column criteria proposed
 - Public hearing 3/19



Questions?

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